

Abstract

An improved echo control system has an echo-containing near signal input. An echo canceller is coupled to a far signal reference and produces an echo estimate signal output representative of the echo contained in the near signal. A signal coupling node is coupled to the near signal input and the echo estimate signal output, and produces an echo-canceled signal output having an echo residue. An echo shaping filter is coupled to the echo-canceled signal output, and reduces the echo residue and provides an echo-suppressed signal output. The echo shaping filter has a spectral response determined by filter coefficients. A background filter is coupled to: (a) an error signal representative of the difference between: (i) the echo canceled signal, and (ii) a signal representative of background filter spectral response, and (b) an adaptive control module producing a reference signal output that is a weighted sum of: (i) the echo-containing signal, and (ii) the echo canceled signal. The background filter updates the filter coefficients of the echo shaping filter responsive to a normalized least mean square (NLMS) algorithm. The improvement includes determining, in the adaptive control module, a reference signal weight for the weighted sum, the weight being proportional to the far signal reference; and an estimate of the norm of an echo canceller error vector, and inversely proportional to an estimate of a residue of the echo canceller; and using a non-linear normalized convergence term in the NLMS algorithm.